

# A Discussion of the Trematode Genus *Schistorchis* (Family Lepocreadiidae) with Descriptions of Two New Species from Hawaii<sup>1</sup>

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THIS REPORT is the first to be based on specimens collected during June and July of 1949 at the Marine Laboratory of the University of Hawaii, Honolulu. To Dr. Robert W. Hiatt, chairman, and to the members of the Department of Zoology and Entomology at the University of Hawaii I wish to extend my sincere appreciation for the laboratory space and the laboratory equipment which were furnished me. To Dr. William A. Gosline, ichthyologist in the Department of Zoology and Entomology at the University of Hawaii, the author is indebted for his invaluable assistance in identifying the fish hosts. The fishes were made available through the generosity and assistance of Mr. Spencer W. Tinker, Director of the Honolulu Aquarium. From all these individuals, and from Dr. H. W. Manter under whose direction the work was done, the author has received valued encouragement. The trip to Hawaii was made possible by a Robert A. Wolcott Scholarship granted by the University of Nebraska Foundation.

The trematodes, upon removal from the hosts, were killed under a cover glass with F.A.A. fixative (formalin, alcohol, and acetic acid). Storage for a short time was in 70 per cent alcohol. The worms were stained in Delafield's haematoxylin, cleared in xylol, and mounted in Permout.

<sup>1</sup> Studies from the Department of Zoology, University of Nebraska, No. 261.

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Type specimens are being deposited at the United States National Museum.

The genus *Schistorchis* Lühe, 1906, now recognized to be quite distinct from *Pleorchis* Railliet, 1896, with which it was once associated, has the following characteristics: medium to large, elongated Homalometroninae; smooth or spined anteriorly; oral sucker terminal or subterminal; ceca long, with or without ani; excretory vesicle I-shaped with long collecting tubules often reaching pharyngeal level; genital pore median or very slightly to the left, just anterior to the acetabulum; cirrus sac absent; genital sinus present; eleven testes intercecal, tandem in a single row or arranged more or less in a double row; ovary pretesticular, median or to the right; seminal receptacle and Laurer's canal present; uterus not extending posterior to the ovary; parasites of marine fishes. Type species: *S. carneus* Lühe, 1906.

In addition to the type species the genus contains four species: *S. callyodontis* Yamaguti, 1942; *S. sigani* Yamaguti, 1942; *S. stenosoma*; and *S. zancli*. The latter two species are here described. The following key to the genus *Schistorchis* is proposed:

1. Testes not in a single median row.....3  
Testes in a single median row.....2
2. Uterus preovarian.....*S. zancli*  
Uterus reaching at least to mid-ovary....  
.....*S. stenosoma*
3. Testes not in two lateral, opposite groups  
.....4  
Testes in two lateral, opposite groups....  
.....*S. carneus*

4. Acetabulum near cecal bifurcation. . . . .  
     . . . . . *S. callyodontis*  
 Space between acetabulum and cecal bifurcation nearly twice length of acetabulum  
     . . . . . *S. sigani*

## SYSTEMATIC POSITION

Lühe (1906: 102) and subsequent authors have associated the genus *Schistorchis* Lühe, 1906, with the genus *Pleorchis* Railliet, 1896. Johnston (1913: 383–386) named *Pleorchis oligorchis* which Odhner (1928: 5) considered identical with the previously described *Schistorchis carneus*. Stunkard (1931: 713–714) quoted the latter paper, apparently in agreement. Yamaguti (1942: 362) referred to "*Schistorchis oligorchis* (Johnston, 1914) [correctly 1913] which is very closely related to if not identical with, *Schistorchis carneus*," seeming to have reached the conclusion independently. Manter and Van Cleave (1951: 331) likewise referred to "*Pleorchis oligorchis* Johnston, 1914 [sic] . . . transferred to *Schistorchis* by Yamaguti (1942)."

Poche (1926: 1–458) placed the genus *Schistorchis* with *Pleorchis* in the family Pleorchiidae where it remained until 1942. Cable and Hunninen (1942: 306) observed that "the genera *Pleorchis* and *Schistorchis* for which Poche (1925) [correctly 1926] erected the family Pleorchiidae, do not seem to be at all closely related" and considered *Pleorchis* among the Acanthocolpidae. Nothing was suggested for *Schistorchis*.

At very nearly the same time, Yamaguti (1942: 364) proposed the separation of *Pleorchis* and *Schistorchis* and erected the new family Schistorchiidae to include *Schistorchis*, and also *Apocreadium* Manter, 1937, and *Choanodera* Manter, 1940, which he considered to resemble *Schistorchis* closely. Both *Choanodera* and *Apocreadium* were considered by Manter (1940: 344–348) as members of the family Gyliuchenidae. Cable and Hunninen (1942: 309) considered the gyliuchenids as related to Lepocreadiidae, and Manter (1947: 264) stated that "*Apocreadium* and *Choanodera*

are so similar to *Homalometron* (differing chiefly in their lymphatic vessels) that they should be transferred to the Homalometroninae, family Lepocreadiidae." Thus *Schistorchis* is the only remaining genus in the family Schistorchiidae.

The genus *Schistorchis* agrees very well with the description of Homalometroninae in the family Lepocreadiidae Nicoll, 1934, as proposed by Cable and Hunninen (1942: 308). Although this is the first report of multiple testes among the Homalometroninae, they are present among the Lepocreadiinae and are provided for in the description of the family.

The presence or absence of ani is often difficult to determine in a whole mount. Both *Schistorchis callyodontis* and *S. sigani* were described from a single specimen. Both Lühe and Johnston described *S. carneus* without ani, but Odhner (1928: 5) found them to be present when he sectioned specimens. Stunkard (1931: 723–724) observed that secondary connections between the intestinal ceca and the exterior have developed independently in several different families and that such communications are not uniformly present in all members of those families in which they do occur. The conclusion was drawn that such connections are relatively recent acquisitions which developed after the families became differentiated.

It is proposed that the genus *Schistorchis* be classified as Homalometroninae, family Lepocreadiidae, and that the family Schistorchiidae become a synonym of Lepocreadiidae.

*Schistorchis stenosoma* n. sp.

Fig. 1a–d

HOST: *Cantherines pardalis* (Ruppell), file fish; in all of 7 specimens examined.

LOCATION: Intestine.

DESCRIPTION (based on a series of 31 specimens): Body 7 or 8 times longer than wide, 1.701 to 4.271 mm. long, 0.211 to 0.635 mm. wide; width about equal along most of body length, but slightly wider immediately ante-

rior to acetabulum; both ends slightly tapered. Rows of widely spaced, short, blunt spines rarely extend as far posterior as acetabulum. Ventrally spines somewhat heavier and extend more posteriorly. Traces of eye-spot pigment present. Oral sucker subterminal, 0.161 to 0.300 mm. long, 0.175 to 0.315 mm. wide, very nearly round. Acetabulum  $1/4$  to  $1/5$  body length from anterior end; 0.117 to 0.234 mm. long by 0.119 to 0.234 mm. wide, very nearly round; sucker ratio 1:0.530 to 1:0.801. Prepharynx very short, appearing absent in many specimens; pharynx rounded, 0.080 to 0.146 mm. long by 0.098 to 0.169 mm. wide; esophagus 0.029 to 0.131 mm. long; bifurcation immediately anterior to acetabulum; area of bifurcation voluminous; ceca parallel to body walls, each terminating in anus; antiterminal, each encircled with cuticular furl. Genital pore median or slightly to left of median line, at anterior border of acetabulum. Testes 11, intercecal, serial and contiguous; 0.044 to 0.190 mm. long by 0.060 to 0.208 mm. wide, anterior testes usually larger than posterior. Pattern of vasa efferentia varied. Usually a single vas efferens from each testis leading to a vas deferens; in some instances two vasa efferentia arise from a common origin on a testis (Fig. 1*b*). Two vasa deferentia just median to ceca enter posterior portion of seminal vesicle separately. Seminal vesicle bipartite; posterior portion 0.095 to 0.354 mm. long by 0.085 to 0.248 mm. wide, rounded, extending posteriorly from level of mid-acetabulum, never reaching ovary, joined to anterior portion by a short, narrow tube; anterior portion much smaller than posterior, longer than wide, variable in size, opening into genital sinus with uterus. Prostatic cells loosely surround anterior portion of seminal vesicle. Ovary round, 0.073 to 0.162 mm. long by 0.080 to 0.162 mm. wide, lying to right of median line just anterior to anterior testis, but never touching it. Uterus with 3 or 4 intercecal coils; entering genital sinus dorsal to acetabulum (Fig. 1*c*). Uterus always extends posteriorly at least to anterior margin

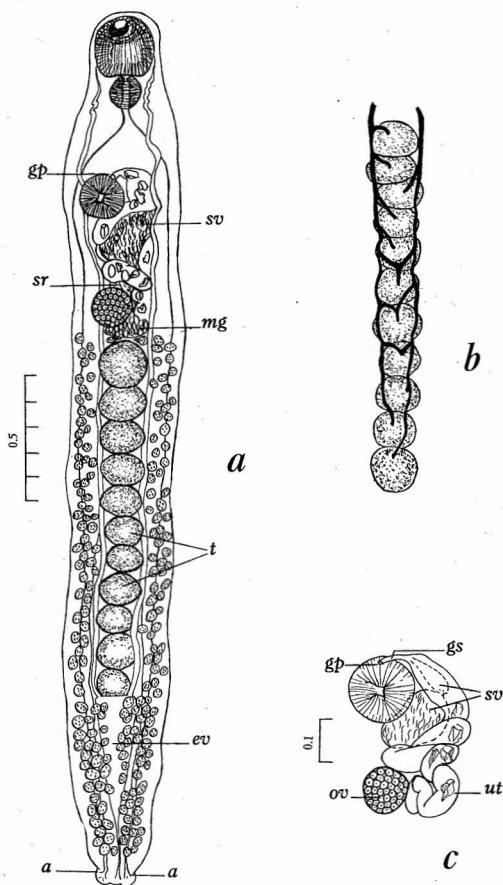


FIG. 1. *Schistorchis stenosoma* from *Cantherines pardalis* (Ruppell), file fish. *a*, Ventral view; *b*, pattern of vasa efferentia and vasa deferentia (diagrammatic); *c*, terminal genital ducts (ventral view); *d*, ootype region (dorsal view). *a*, *c*, and *d* drawn with the aid of a camera lucida. Projected scale in millimeters. Abbreviations: *a* = anus, *e* = egg, *ev* = excretory vesicle, *gp* = genital pore, *gs* = genital sinus, *lc* = Laurer's Canal, *mg* = Mehli's gland, *ov* = ovary, *sr* = seminal receptacle, *sv* = seminal vesicle, *t* = testis, *ut* = uterus.

of ovary, usually to posterior margin of ovary, occasionally slightly beyond ovary although never reaching anterior testis. Mehli's gland dorsal to ovary, diffuse, extending from anterior edge of anterior testis to level of mid-ovary, intercecal. Laurer's canal well developed, opening midway between acetabulum and ovary, dorsal to left cecum; a short, narrow tube directed first medianly and then posteriorly, enlarging into receptacle-like por-

tion, then again narrowly tubular to ootype. Connection between ootype and true seminal receptacle clearly discernible (Fig. 1*d*). Seminal receptacle 0.065 to 0.190 mm. long by 0.078 to 0.218 mm. wide, as large as or larger than ovary; slightly anterior to, more median and more dorsal than ovary; vitellaria follicular from level of anterior testis (3 or 4 follicles anterior to anterior testis) to posterior end of body; lateral and ventral to ceca, very few intercecal follicles anterior to posterior testis, then becoming confluent. Eggs relatively few (7 to 15), usually collapsed, 37 to 68 by 22 to 43  $\mu$ , usual range 51 to 56 by 31 to 36  $\mu$ . Excretory pore terminal between anal furcs; excretory vesicle I-shaped, extending to posterior edge of posterior testis, joined there by principal pair of collecting tubules. Tubules extend anteriorly just median to ceca, cross ceca ventrally at acetabular level, narrow and tend to coil slightly at pharyngeal level, then continue forward lateral to oral sucker.

COMPARISONS: *S. stenosoma*, with the 11 testes in a single, median row, with the uterus found at least as far posterior as mid-ovary and sometimes slightly posterior to the posterior border of the ovary, and with body spines, differs from all previously described species of *Schistorchis*.

*S. carneus* was originally described with cirrus sac and without ani, but Yamaguti (1942: 362) concluded that the cirrus sac was absent, and Odhner (1928: 5) described the ani. *S. carneus* differs from *S. stenosoma* in its bulkier body proportions, the retracted oral sucker, the smaller pharynx, the apparent absence of an esophagus, the long excretory vesicle which extends anterior to the ovary, and the arrangement of the testes in two lateral groups.

*S. callyodontis* differs from *S. stenosoma* by its lack of ani, the longer excretory vesicle, the ovary which is at the same level as the anterior testis, the nearly equal size of the suckers, the testes arranged irregularly in two rows, and the heavy musculature of the anterior portion of the body.

*S. sigani* differs from *S. stenosoma* by its lack of ani, the longer excretory vesicle, the very short esophagus, the wide area between the intestinal bifurcation and the acetabulum, the nearly equal size of the suckers, the small pharynx, the testes which are arranged irregularly in two rows, and the larger eggs.

The name *stenosoma* is a combination of steno- (narrow) and soma (body), referring to the relative slenderness of the body.

### *Schistorchis zancli* n. sp.

Fig. 2*a, b*

HOST: *Zanclus cornutus* (L.), Moorish idol or kihikihi loulou; in 1 of 9 specimens examined.

LOCATION: Intestine.

DESCRIPTION (based on two specimens): Body elongate, 2.409 to 2.643 mm. long, 0.606 to 0.686 mm. wide; widest at acetabular level, tapering abruptly anteriorly at esophageal level and posteriorly at level of second testis; width of narrower posterior portion nearly equal; anterior end blunt, posterior end rounded. A few small, scattered spines present anterior to level of esophagus. Traces of eyespot pigment present. Oral sucker subquadrate, terminal, 0.168 to 0.196 mm. long by 0.256 mm. wide. Acetabulum  $1/3$  body length from anterior end; rounded, 0.197 to 0.204 mm. long by 0.183 to 0.190 mm. wide; sucker ratio 1:0.715 to 1:0.742. Very short prepharynx observed in one specimen; pharynx 0.119 to 0.133 mm. long by 0.128 to 0.146 mm. wide, nearly rectangular; esophagus 0.043 to 0.085 mm. long; ceca wide anteriorly, narrowing posterior to acetabulum, nearly parallel to body walls, each with ventral, subterminal anus. Genital pore slightly to left of median line at anterior border of acetabulum. Testes 11, largely intercecal but occasionally ventral to median portion of ceca, serial and contiguous, 0.080 to 0.168 mm. long by 0.141 to 0.199 mm. wide, ellipsoidal to ovoid in shape. Seminal vesicle 0.256 to 0.285 mm. long by 0.183 to 0.219 mm. wide, saccular, with slightly swollen tube extending

from seminal vesicle to shallow genital sinus. Seminal vesicle ovoid, extending posteriorly nearly to ovary, narrowing into nonmuscular pars prostatica surrounded by several prostatic cells. Cirrus lacking. Ovary rounded, 0.124 to 0.153 mm. long by 0.146 to 0.153 mm. wide, lying to right of median line, contiguous with anterior testis. Short uterus without lateral coils, with 2 straight, longitudinal limbs, one ventral, one dorsal; latter joining pars prostatica near genital pore (Fig. 2*b*), intercecal, to left of median line, preovarian and well filled with eggs. Mehlis' gland dorsal and to left of ovary, diffuse, extending from level of mid-ovary anteriorly, slightly larger than ovary. Laurer's canal well developed, opening dorsal to left cecum at level of seminal vesicle, directed at first anteriorly than at mid-acetabular level turning backward; basal portion near ovary swollen. Seminal receptacle large, claviform, lying dorsal to and slightly anterior to ovary. Vitellaria of small follicles often grouped 2 or 3 together, extending from level of posterior edge of acetabulum to very near posterior end of body, lateral and ventral to ceca, somewhat confluent posterior to testes. Prominent yolk ducts extend from both sides at level of ovary, ducts seemingly swollen into reservoirs in one specimen. Eggs usually collapsed, 48 to 54 by 36 to 43  $\mu$  (majority 51 to 53 by 36 to 39  $\mu$ ). Excretory pore ventral, subterminal, slightly anterior to ani and on median line; I-shaped vesicle, extending to posterior edge of posterior testis, joined there by principal pair of collecting tubules; tubules extend anteriorly just median to ceca, cross ceca ventrally beginning at level of ovary, continuing forward to pharyngeal level.

COMPARISONS: *S. zancli* is most similar to *S. stenosoma* of the other known species of the genus. *S. zancli* is like *S. stenosoma* and different from all other species in the genus in the possession of body spines, and in the presence of 11 testes arranged in a single, median row. It differs from *S. stenosoma* in that it has a more rhomboidal oral sucker, a larger, more rec-

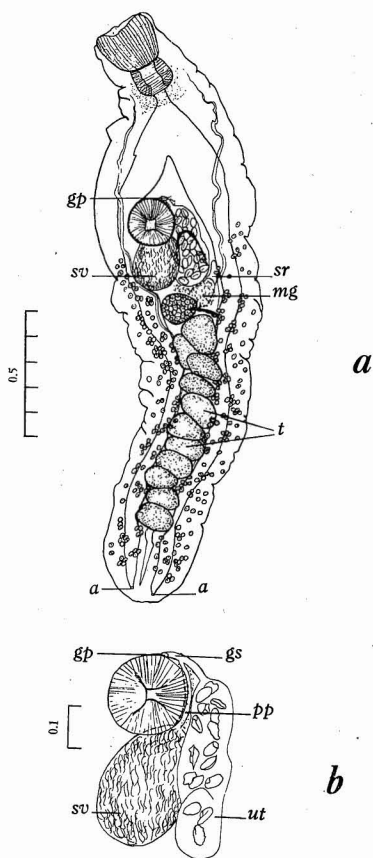


FIG. 2. *Schistorchis zancli* from *Zanclus cornutus* (L.), Moorish idol or kihikihi loulu. *a*, Ventral view; *b*, terminal genital ducts (ventral view). Drawn with the aid of a camera lucida. Projected scale in millimeters. Abbreviations: *a* = anus, *gp* = genital pore, *gs* = genital sinus, *mg* = Mehlis' gland, *pp* = pars prostatica, *sr* = seminal receptacle, *sv* = seminal vesicle, *t* = testis, *ut* = uterus.

tangular pharynx, a greater angle at the origin of the ceca, a relatively more posterior acetabulum, more anterior extent of the vitellaria, fewer and smaller vitelline follicles, a more robust body, a preovarian uterus, ellipsoidal or ovoid rather than round testes, a relatively shorter posttesticular space, a non-muscular pars prostatica, a non-bipartite seminal vesicle, subterminal ani without cuticular furls, and a subterminal excretory pore.

The name *zancli* refers to *Zanclus*, the genus of the host.

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